

CHAPTER - IV

ANALYSIS AND INTERPRETATIONS OF DATA

4.1 INTRODUCTION

In general data may be valid, reliable and adequate. But they do not serve any useful purpose unless they were carefully processed, systematically shifted, classified, tabulated, scientifically analyzed, intelligently interpreted and rationally concluded. After the data have been collected, they should be processed and critically analyzed to drop exact conclusion. In the present study the collected data analyzed using univariate and multivariate analysis. The result and discussion on findings of treatment effect individually and comparatively on variables used in the present study are presented in this chapter.

4.2 LEVEL OF SIGNIFICANCE

To test the obtained results on variables, level of significance 0.05 was chosen and considered as sufficient for the present study

4.3 RESULT OF TREATMENT EFFECTS

The statistical analysis of pre-post test of RTAG, RTAMG and Control groups in the selected physical and physiological variables are presented in the Table 4.1 to 4.3.

TABLE 4.1

Significance of mean gains/ loses between and pre and post tests of Resistance training with Asanas Group (RTAG) on physical and physiological variables of men adults.

Variables	Pre test Mean ± S.D	Post test Mean ± S.D	Mean Diff.	SEM	't'-ratio
Upper body muscular strength (in kgs)	36.25 ±3.46	44.20 ±4.41	7.95	0.46	17.44*
Lower body muscular strength (in kgs)	50.75 ±8.43	70.25 ±6.73	19.50	1.17	16.62*
Muscular strength endurance (in Nos.)	25.65 ±5.31	31.30 ±4.05	5.65	0.45	12.43*
Flexibility (in cms)	29.30 ±4.92	40.85 ±4.42	11.55	1.20	9.56*
Cardio-vascular endurance (min and sec)	14.51 ±1.37	13.02 ±1.23	1.49	0.18	8.31*
Resting pulse rate (beats per min)	77.10 ±3.29	71.30 ±2.34	5.80	0.44	13.04*
Systolic blood pressure (in mm/hg)	118.75 ±6.84	114.00 ±5.57	4.75	0.79	5.98*
Diastolic blood pressure (in mm/hg)	71.05 ±3.46	67.45 ±2.89	3.60	0.34	10.73*
Vo ₂ max (ml/kg/min)	44.79 ±5.63	55.01 ±4.51	10.22	1.16	8.78*

***Significant at 0.05 level: 2.09**

Table 4.1 indicates the obtained 't' values of the resistance training with asanas on variables of: 17.44 (upper body muscular strength), 16.62 (lower body muscular strength), 12.43 (muscular strength endurance), 9.56 (flexibility), 8.31 (cardiovascular endurance), 13.04 (resting pulse), 5.98 (systolic blood pressure), 10.73 (diastolic blood pressure) and 8.78 (VO₂ max). The obtained t- values to be significant at 0.05 level for degree of freedom 1, 14 the required critical value was 2.09. Hence the obtained t-values on the variables higher than the required critical values, it is concluded that the Resistance training with Asanas Group (RTAG), produced significant improvement in upper body muscular strength (7.95 p<0.05), lower body muscular strength (19.50 p<0.05), muscular strength endurance (5.65 p<0.05), flexibility (11.55 p<0.05), cardio vascular endurance (1.49 p<0.05), resting pulse rate (5.80 p<0.05), systolic blood pressure (4.75 p<0.05), diastolic blood pressure (3.60 p<0.05) and Vo₂ max (10.22 p<0.05).

TABLE 4.2

Significance of mean gains/ loses between and pre and post tests of Resistance training with Ayurvedic Massage Group (RTAMG) on physical and physiological variables of men adults.

Variables	Pre test Mean ± S.D	Post test Mean ± S.D	Mean Diff.	SEM	't'-ratio
Upper body muscular strength (in kgs)	36.90 ±3.19	46.15 ±3.47	9.25	0.43	21.59*
Lower body muscular strength (in kgs)	53.60 ±8.78	75.65 ±9.98	22.05	1.34	16.47*
Muscular strength endurance (in Nos.)	24.50 ±3.97	31.55 ±3.24	7.05	0.47	14.91*
Flexibility (in cms)	29.30 ±4.92	40.85 ±4.42	11.55	1.21	9.56*
Cardio-vascular endurance (in min and sec)	13.91 ±1.42	12.79 ±1.10	1.12	0.24	4.65*
Resting pulse rate (in beats per min)	78.50 ±2.98	70.85 ±1.93	7.65	0.57	13.36*
Systolic blood pressure (in mm/hg)	117.95 ±5.48	110.15 ±5.54	7.80	0.66	11.76*
Diastolic blood pressure (in mm/hg)	70.55 ±3.30	66.35 ±3.96	4.20	0.40	10.47*
Vo ₂ max (ml/kg/min)	47.15 ±6.23	58.75 ±5.43	11.59	1.26	9.21*

***Significant at 0.05 level: 2.09**

Table 4.2 indicates the obtained 't' values of the resistance training with ayurvedic massage on variables of: 21.59 (upper body muscular strength), 16.47 (lower body muscular strength), 14.91 (muscular strength endurance), 9.56 (flexibility), 4.65 (cardiovascular endurance), 13.36 (resting pulse), 11.76 (systolic blood pressure), 10.47 (diastolic blood pressure) and 9.21 (VO₂ max). The obtained t- values to be significant at 0.05 level for degree of freedom 1, 14 the required critical value was 2.09. Hence the obtained t-values on the variables higher than the required critical values, it is concluded that the Resistance training with ayurvedic massage (RTAM), produced significant improvement in upper body muscular strength (9.25 p<0.05), lower body muscular strength (22.05 p<0.05), muscular strength endurance (7.05 p<0.05), flexibility (11.55 p<0.05), cardio vascular endurance (1.12 p<0.05), resting pulse rate (7.65 p<0.05), Systolic blood pressure (7.80 p<0.05), diastolic blood pressure (4.20 p<0.05) and vo₂max (11.59 p<0.05).

TABLE 4.3

Significance of mean gains/ loses between and pre and post tests of Control Group (CG) on physical and physiological variables of men adults.

Variables	Pre test Mean ± S.D	Post test Mean ± S.D	Mean Diff.	SEM	't'-ratio
Upper body muscular strength(in kgs)	34.60 ±3.23	34.75 ±2.88	0.15	0.26	0.57
Lower body muscular strength (in kgs)	47.30 ±7.06	48.30 ±7.17	1.00	0.59	1.68
Muscular strength endurance (in Nos.)	25.00 ±3.23	25.65 ±3.18	0.65	0.38	1.72
Flexibility (in cms)	30.45 ±4.97	31.00 ±6.48	0.55	0.71	0.78
Cardio-vascular endurance (in min and sec)	14.91 ±1.03	14.82 ±0.82	0.09	0.12	0.77
Resting pulse rate (in beats per min)	77.65 ±3.10	76.80 ±2.71	0.85	0.50	1.70
Systolic blood pressure (in mm/hg)	122.65 ±8.32	124.60 ±7.07	1.95	1.64	1.19
Diastolic blood pressure (in mm/hg)	69.60 ±2.21	69.25 ±2.22	0.35	0.24	1.44
Vo ₂ max (ml/kg/min)	47.02 ±4.32	47.24 ±3.54	0.22	0.73	0.30

Table 4.3 indicates the obtained 't' values of the control group on variables of: 0.57 (upper body muscular strength), 1.68 (lower body muscular strength), 1.72 (muscular strength endurance), 0.78 (flexibility), 0.77 (cardiovascular endurance), 1.70 (resting pulse), 1.19 (systolic blood pressure), 1.44 (diastolic blood pressure) and 0.30 (VO₂ max). The obtained t-values to be significant at 0.05 level for degree of freedom 1, 14 the required critical value was 2.09. Hence the obtained t-values on the variables were failed to reach the significant level, it is concluded that the changes made from pre-test to post test is statistically not significant.

The changes made from the baseline to the post treatment of Resistance Training with Asanas Group (RTAG), Resistance Training with Ayurvedic Massage Group (RTAMG) and Control Group (CG) on physical fitness components (upper body muscular strength, lower body muscular strength, Muscular strength endurance, flexibility and cardio-respiratory endurance), body composition indices (percent body fat and lean body mass) and physiological variables (resting pulse rate, systolic blood pressure, diastolic blood pressure and Vo₂ max) are presented in Figure 4.1 to 4.9.

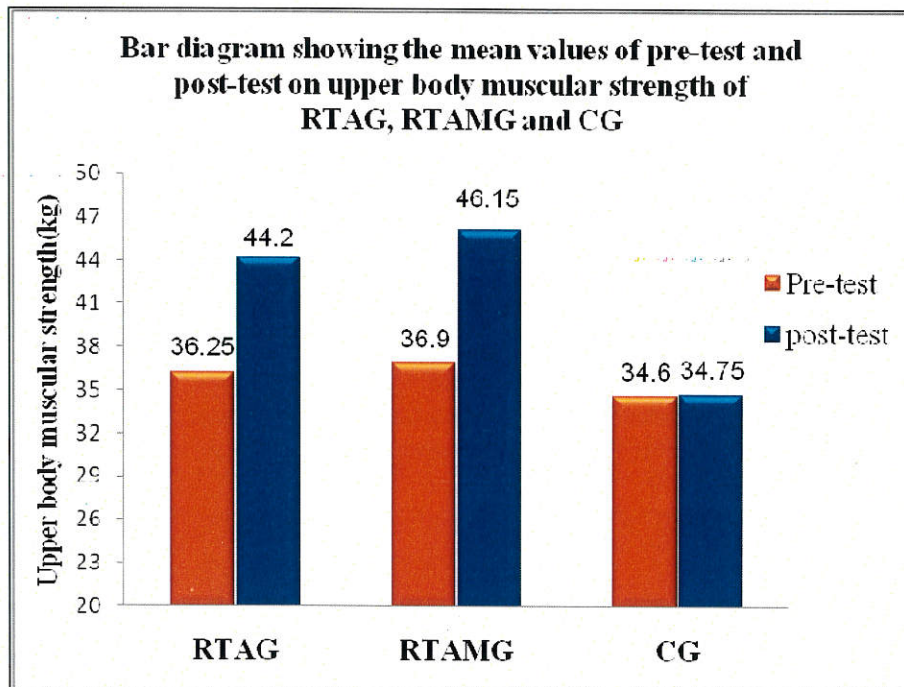


Fig: 4.1

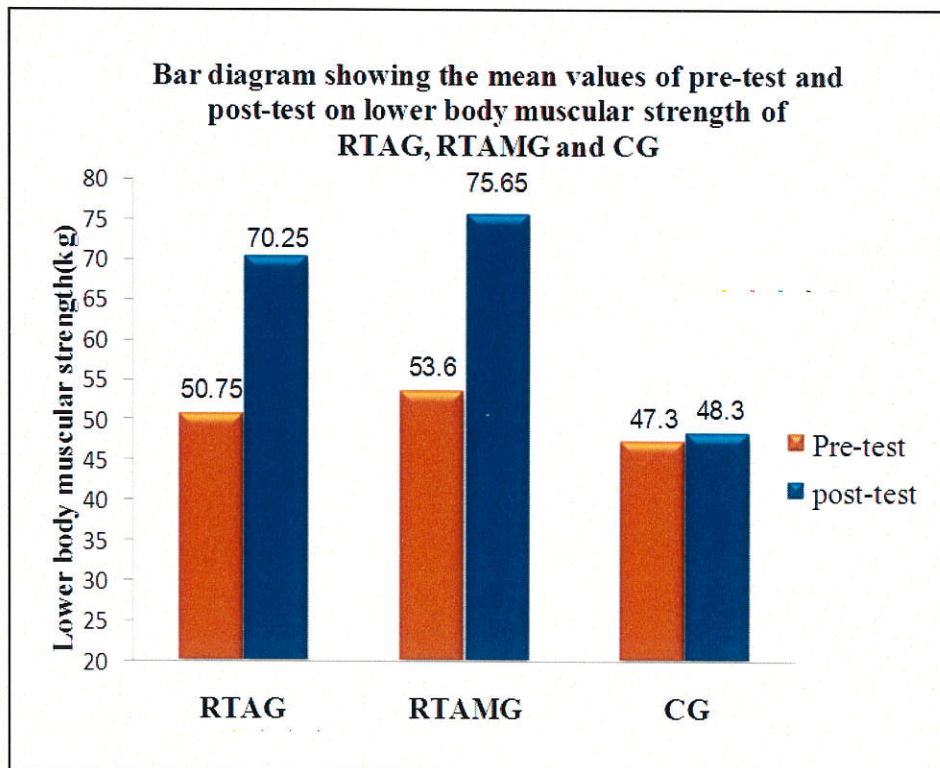


Fig: 4.2

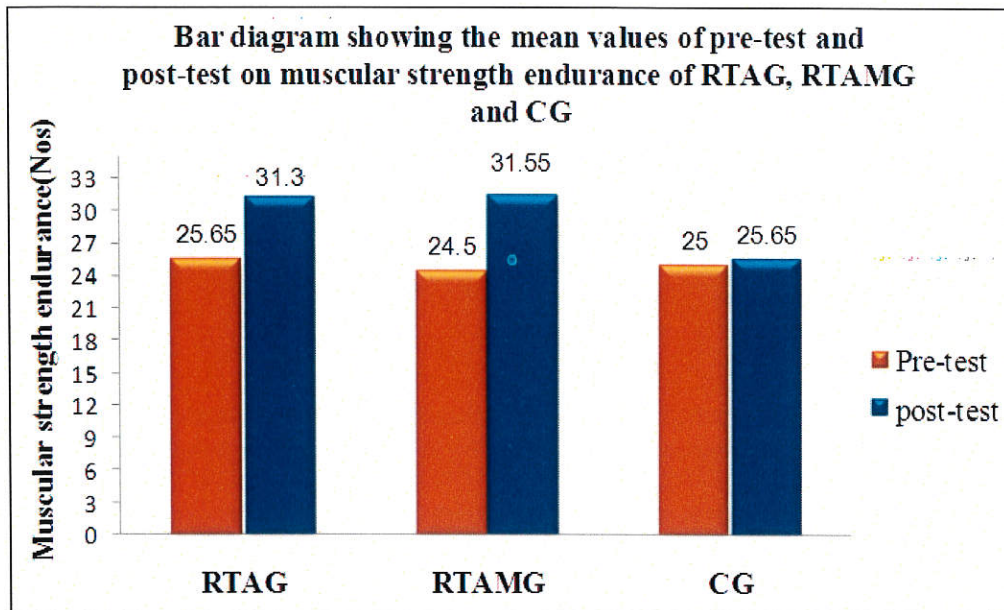


Fig: 4.3

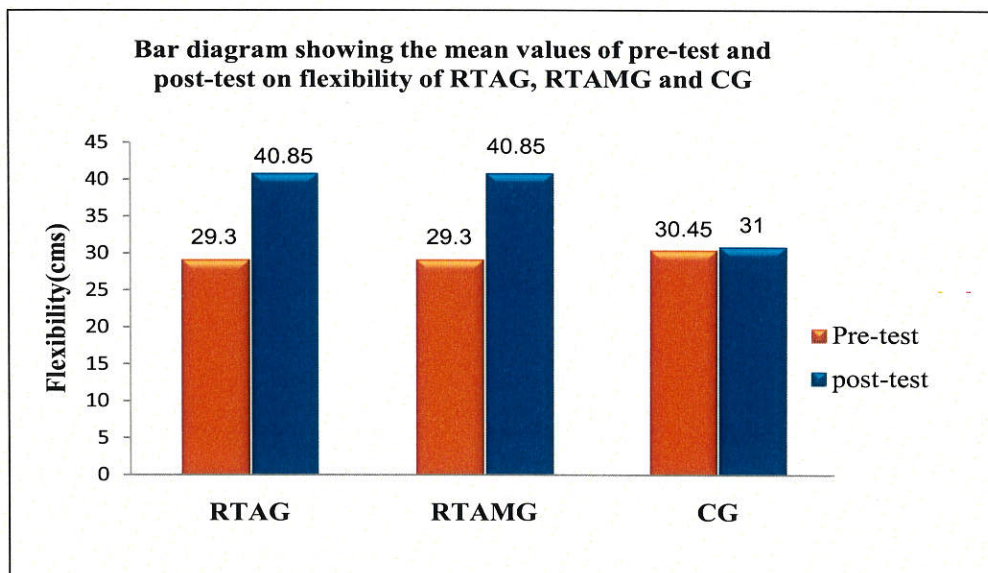


Fig: 4.4

TABLE - 4.4

Analysis of variance on pre test means among the Resistance training with asanas Group (RTAG), Resistance training with Ayurvedic Massage Group (RTAMG) and control group (CG) on physical fitness components and physiological variables of men adults.

Variables	Sources of Variance	Sum of Squares	df	Mean Square	F-ratio
<i>Physical Fitness Variables</i>					
Upper body muscular strength (in kgs)	Between sets	56.23	2	28.12	2.58
	Within sets	620.35	57	10.88	
Lower body muscular strength (in kgs)	Between sets	398.1	2	199.05	3.02
	Within sets	3760.75	57	65.98	
Muscular strength endurance (in Nos.)	Between sets	13.3	2	6.65	0.37
	Within sets	1033.55	57	18.13	
Flexibility (in cms)	Between sets	15.1	2	7.55	0.41
	Within sets	1058.15	57	18.56	
Cardio-vascular endurance (in min and sec)	Between sets	10.10	2	5.05	3.05
	Within sets	94.48	57	1.66	
<i>Physiological Variables</i>					
Resting pulse rate(in beats/min)	Between sets	19.9	2	9.95	1.02
	Within sets	557.35	57	9.78	
Systolic blood pressure (in mm/hg)	Between sets	252.93	2	126.47	2.60
	Within sets	2775.25	57	48.67	
Diastolic blood pressure in (in mm/hg)	Between sets	21.7	2	10.85	1.17
	Within sets	526.7	57	9.24	
Vo ₂ max (ml/kg/min)	Between sets	70.44	2	35.22	1.19
	Within sets	1693.91	57	29.72	

TABLE - 4.5

Analysis of variance on post test means among the Resistance training with asanas Group (RTAG), Resistance training with Ayurvedic Massage Group (RTAMG) and control group (CG) on physical fitness components and physiological variables of men adults.

Variables	Sources of Variance	Sum of Squares	df	Mean Square	F-ratio
<i>Physical Fitness Variables</i>					
Upper body muscular strength (in kgs)	Between sets	1487.1	2	743.55	56.10*
	Within sets	755.5	57	13.25	
Lower body muscular strength (in kgs)	Between sets	8393.23	2	4196.62	64.12*
	Within sets	3730.5	57	65.45	
Muscular strength endurance (in Nos.)	Between sets	445.3	2	222.65	18.03*
	Within sets	703.7	57	12.35	
Flexibility (in cms)	Between sets	1022.23	2	511.12	17.91*
	Within sets	1626.35	57	28.53	
Cardio-vascular endurance (in min and sec)	Between sets	49.18	2	24.59	21.65*
	Within sets	64.73	57	1.14	
<i>Physiological Variables</i>					
Resting pulse rate(in beats/min)	Between sets	439.03	2	219.52	39.85*
	Within sets	313.95	57	5.51	
Systolic blood pressure (in mm/hg)	Between sets	2239.9	2	1119.95	30.06*
	Within sets	2123.35	57	37.25	
Diastolic blood pressure (in mm/hg)	Between sets	85.73	2	42.87	4.43*
	Within sets	551.25	57	9.67	
Vo ₂ max (ml/kg/min)	Between sets	1378.53	2	689.27	33.18*
	Within sets	1183.96	57	20.77	

***Significant at 0.05 level (3.22)**

4.4 RESULTS

4.4.1 Analysing of significance of mean difference on criterion variables

In analysis of covariance, analyzing the data on pre test means and post test means among the resistance training with asanas group, resistance training with Ayurvedic massage group and control group on criterion variables is the preliminary process. As the final step of analysis of covariance, the post test means are adjusted for differences in the pre test means, and the adjusted means are tested for significance. Thus the data were analyzed and the results on pre test, post test and adjusted test are as follows.

4.5 RESULTS ON PRE TEST MEANS

In testing the pre test means among the resistance training with asanas group, resistance training with Ayurvedic massage group and control group on criterion variables, the obtained F-ratios are: 2.58 (upper body muscular strength), 3.02 (lower body muscular strength), 0.37 (muscular strength endurance), 0.41 (flexibility), 3.05 (cardiovascular endurance), 1.02 (resting pulse), 2.60 (systolic blood pressure), 1.17 (diastolic blood pressure) and 1.19 (VO₂ max). The obtained F-ratios were statistically not significant since they failed to reach the critical value (3.22) at 0.05 level. Thus the obtained results on pre test means confirm the random assignment of subjects into different groups was successful.

4.6 RESULTS ON POST TEST MEANS

In testing the post test means among the resistance training with asanas, resistance training with Ayurvedic massage and control group on criterion variables, the obtained f-ratios are: 56.10 (upper body muscular strength), 64.12 (lower body muscular strength), 18.03 (muscular strength endurance), 17.91 (flexibility), 21.65 (cardiovascular endurance), 39.85 (resting pulse), 30.06 (systolic blood pressure), 4.43 (diastolic blood pressure) and 33.18 (VO₂ max). The obtained F-ratios were explained that

after completion of treatment period of 12 weeks, the mean difference exist among the three groups of RTAG, RTAMG and CG was statistically significant.

TABLE - 4.6

Analysis of covariance on adjusted post test means among the Resistance training with Asanas Group (RTAG), Resistance training with Ayurvedic Massage Group (RTAMG) and control group (CG) on physical fitness components and physiological variables of men adults

Variables	Sources of Variance	Sum of Squares	df	Mean Square	F-ratio
<i>Physical Fitness Variables</i>					
Upper body muscular strength(in kgs)	Between sets	903.83	2	451.92	144.94*
	Within sets	174.60	56	3.12	
Lower body muscular strength(in kgs)	Between sets	5294.26	2	2647.13	122.16*
	Within sets	1213.51	56	21.67	
Muscular strength endurance(in Nos)	Between sets	448.12	2	224.09	86.28*
	Within sets	145.44	56	2.60	
Flexibility(in cms)	Between sets	1169.54	2	584.77	27.44*
	Within sets	1193.34	56	21.31	
Cardio-vascular endurance (in min and sec)	Between sets	27.39	2	13.69	28.45*
	Within sets	26.95	56	0.481	
<i>Physiological Variables</i>					
Resting pulse rate(in beats/min)	Between sets	461.38	2	230.69	78.48*
	Within sets	164.61	56	2.94	
Systolic blood pressure (in mm/hg)	Between sets	1286.21	2	643.10	34.77*
	Within sets	1035.74	56	18.50	
Diastolic blood pressure (in mm/hg)	Between sets	156.54	2	78.27	36.04*
	Within sets	121.61	56	2.17	
Vo ₂ max (ml/kg/min)	Between sets	1432.12	2	716.09	48.50*
	Within sets	826.87	56	14.77	

***Significant at 0.05 level (3.23)**

4.7 RESULTS ON ADJUSTED MEANS

In testing the adjusted means among the resistance training with asanas group, resistance training with ayurvedic massage group and control group on criterion variables, the obtained f-ratios are: 144.94 (upper body muscular strength), 122.16 (lower body muscular strength), 86.28 (muscular strength endurance), 27.44 (flexibility), 28.45 (cardiovascular endurance), 78.48 (resting pulse), 34.77 (systolic blood pressure), 36.04 (diastolic blood pressure) and 48.50 (VO₂ max). The obtained F- ratios on the above said criterion variables among the three groups were significant at 0.05 level since they exceeds the required critical value (3.23 df 2, 41). Thus the obtained results on adjusted means statistically confirm the differences exist after completion of treatment period on criterion variables among the three different groups such as the RTAG, RTAMG and CG. Further to identify the specific differences among three groups, the Scheffe's post-hoc test was performed. The results of post-hoc tests are as follows.

TABLE - 4.7
SCHEFEE'S POST HOC TEST

VARIABLES	RTAG	RTAMG	CG	M.D	F-value	C.V
Upper body muscular strength (in kgs)	43.88	45.19	-----	1.31	5.60	6.46
	43.88	-----	36.02	7.86	197.81*	6.46
	-----	45.19	36.02	9.17	269.95*	6.46
Lower body muscular strength (in kgs)	70.09	73.15	-----	3.06	4.34	6.46
	70.09	-----	50.96	19.13	168.84*	6.46
	-----	73.15	50.96	22.19	227.35*	6.46
Muscular strength endurance (in Nos.)	30.86	31.95	-----	1.09	4.62	6.46
	30.86	-----	25.69	5.17	103.01*	6.46
	-----	31.95	25.69	6.26	151.25*	6.46
Flexibility (in cms)	41.14	38.06	-----	3.08	4.45	6.46
	41.14	-----	30.55	10.59	52.58*	6.46
	-----	38.06	30.55	7.51	26.45*	6.46

VARIABLES	RTAG	RTAMG	CG	M.D	F-value	C.V
Cardio-vascular endurance (in min and sec)	12.98	13.13	-----	0.15	0.47	6.46
	12.98	-----	14.52	1.51	49.48*	6.46
	-----	13.13	14.52	1.39	40.30*	6.46
Resting pulse rate (in beats/min)	71.64	70.46	-----	1.18	4.69	6.46
	71.64	-----	76.85	5.21	92.53*	6.46
	-----	70.46	76.85	6.39	138.91*	6.46
Systolic blood pressure (in mm/hg)	114.65	111.30	-----	3.35	6.06	6.46
	114.65	-----	122.81	8.16	35.99*	6.46
	-----	111.30	122.81	11.51	71.60*	6.46
Diastolic blood pressure (in mm/hg)	66.86	66.21	-----	0.65	1.94	6.46
	66.86	-----	69.97	3.11	44.53*	6.46
	-----	66.21	69.97	3.76	65.03*	6.46
Vo ₂ max (ml/kg/min)	55.71	58.36	-----	2.65	4.77	6.46
	55.71	-----	46.92	8.79	52.36*	6.46
	-----	58.36	46.92	11.44	88.72*	6.46

***Significant at 0.05 level (6.46)**

4.8 RESULTS ON POST HOC TEST

Comparing the Effect of Resistance training with Asanas Group (RTAG) and Resistance Training with Ayurvedic Massage Group (RTAMG).

In comparing the effect of resistance training with asanas, and resistance training with Ayurvedic massage on physical and physiological variables, it was found that both the groups produced similar effect on upper body muscular strength (5.60 $p < 0.05$), lower body muscular strength (4.34 $p < 0.05$), muscular strength endurance (4.62 $p < 0.05$), flexibility (4.45 $p < 0.05$), cardio vascular endurance (0.47 $p < 0.05$), resting pulse rate (4.69 $p < 0.05$), Systolic blood pressure (6.06 $p < 0.05$), diastolic blood pressure (1.94 $p < 0.05$) and Vo₂ max (4.77 $p < 0.05$).

Comparing the Effect of Resistance training with Asanas Group (RTAG) and Control Group (CG).

In comparing the effects of resistance training with asanas, and the control group on physical and physiological variables, it was found that RTAG showed better performance on upper body muscular strength (197.81 $p < 0.05$), lower body muscular strength (168.84 $p < 0.05$), muscular strength endurance (103.01 $p < 0.05$), flexibility (52.58 $p < 0.05$), cardio vascular endurance (49.48 $p < 0.05$), resting pulse rate (92.53 $p < 0.05$), systolic blood pressure (35.99 $p < 0.05$), diastolic blood pressure (44.53 $p < 0.05$) and Vo_2 max (52.36 $p < 0.05$) than the control group.

Comparing the Effect of Resistance Training with Ayurvedic Massage Group (RTAMG) and Control Group (CG).

In comparing the effects of resistance training with Ayurvedic massage and the control group on physical and physiological variables, from the obtained f-ratios, it was found out that RTAMG showed better performance on upper body muscular strength (269.95 $p < 0.05$), lower body muscular strength (227.35 $p < 0.05$), muscular strength endurance (151.25 $p < 0.05$), flexibility (26.45 $p < 0.05$), cardio vascular endurance (40.30 $p < 0.05$), resting pulse rate (138.91 $p < 0.05$), systolic blood pressure (71.60 $p < 0.05$), diastolic blood pressure (65.03 $p < 0.05$) and Vo_2 max (88.72 $p < 0.05$) than the control group.

Graphical representation of adjusted post-test means of Resistance Training with asanas Group (RTAG), Resistance Training with Ayurvedic Massage Group (RTAMG) and Control Group (CG) on physical fitness components (upper body muscular strength, lower body muscular strength, Muscular strength endurance, flexibility and cardio-vascular endurance), physiological variables (resting pulse rate, systolic blood pressure, diastolic blood pressure and Vo_2 max) are presented in Figure 4.10 to 4.18.

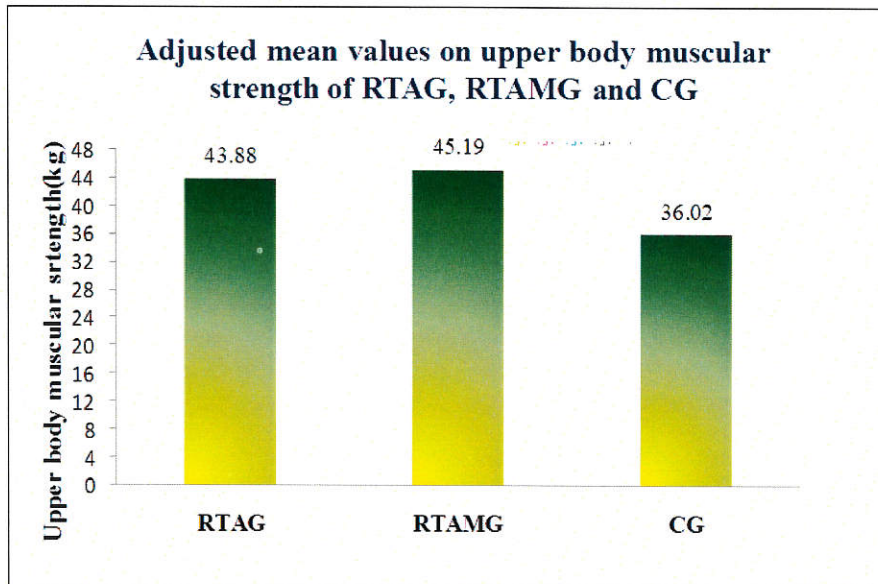


Fig 4.10

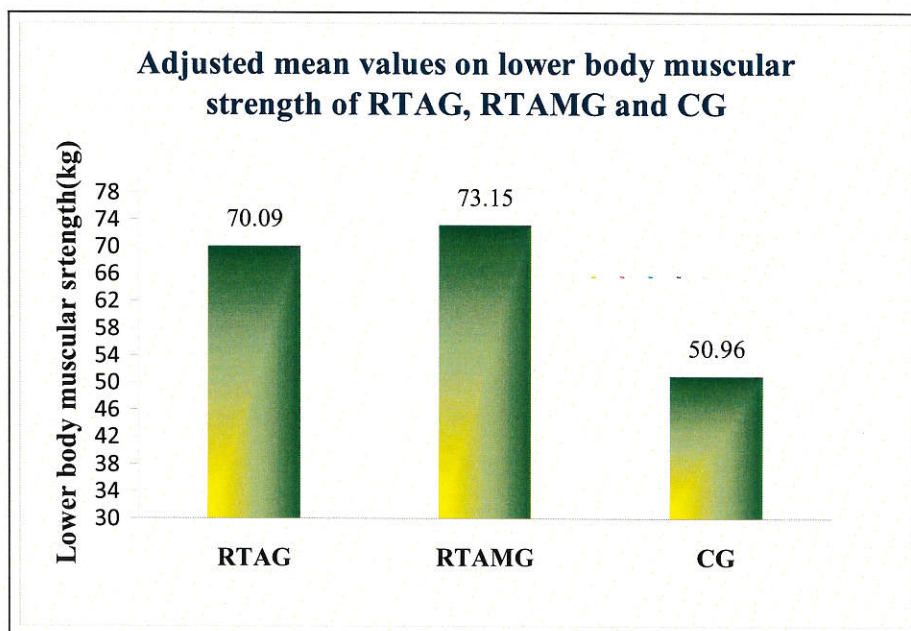


Fig 4.11

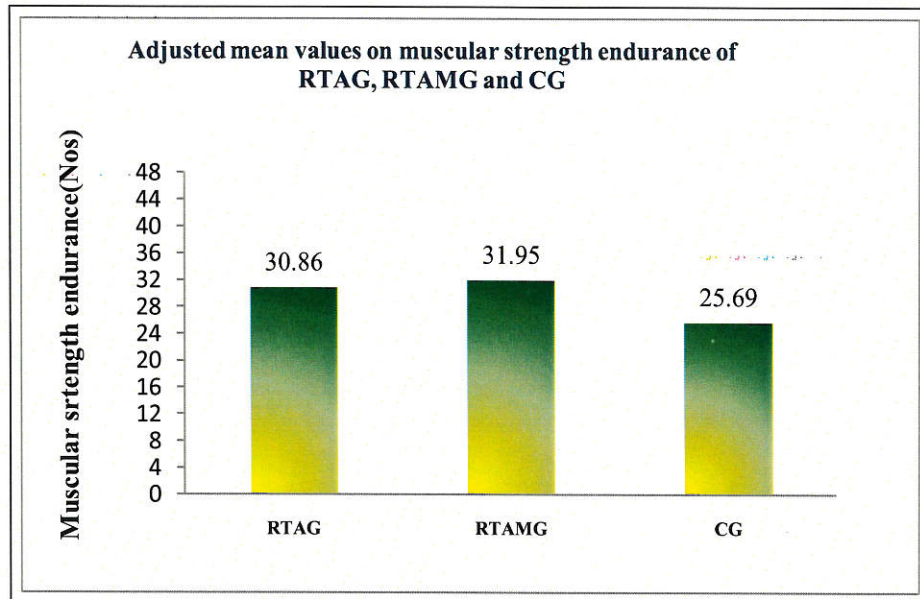


Fig 4.12

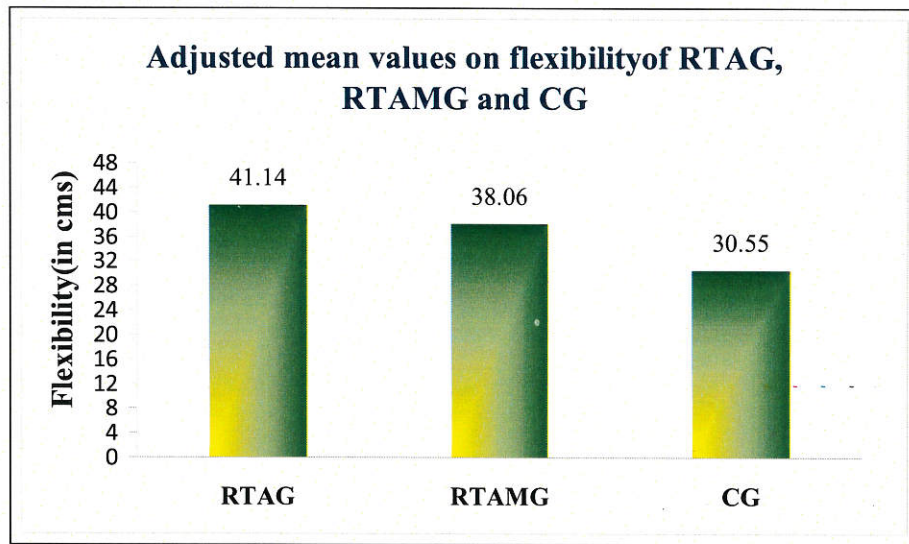


Fig 4.13

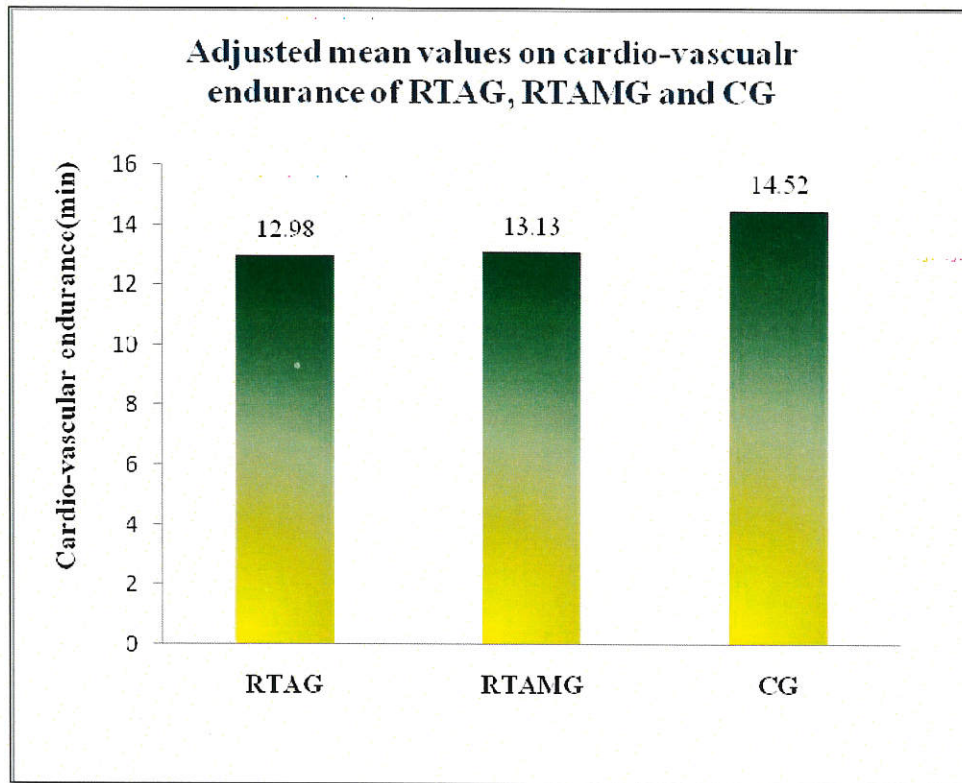


Fig 4.14

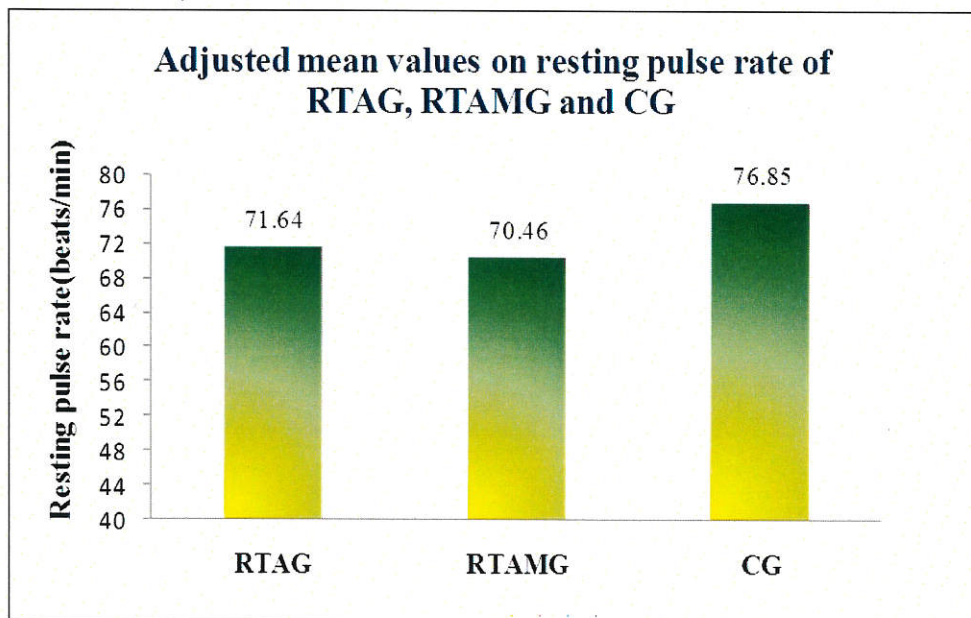


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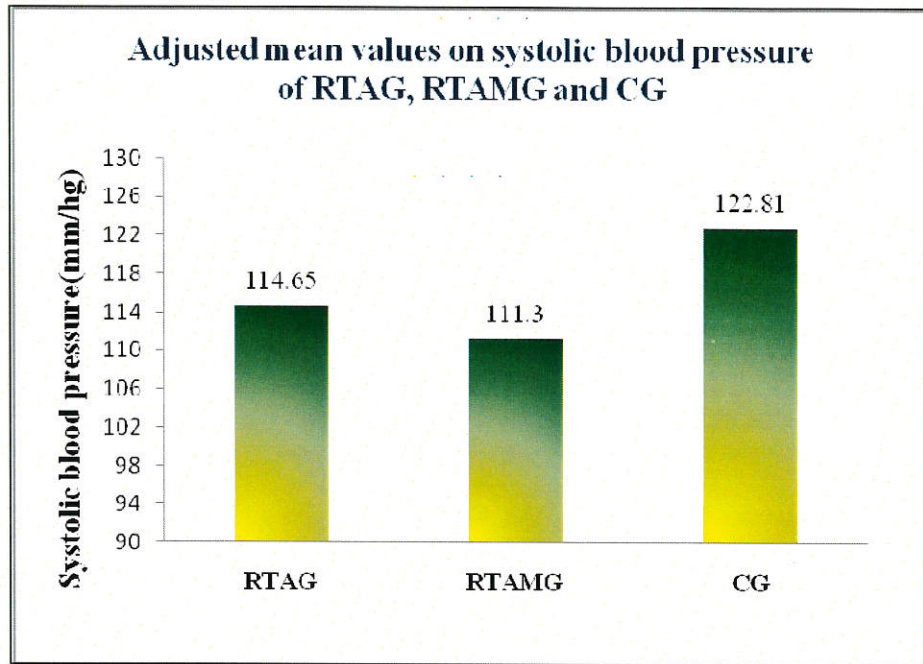


Fig 4.16

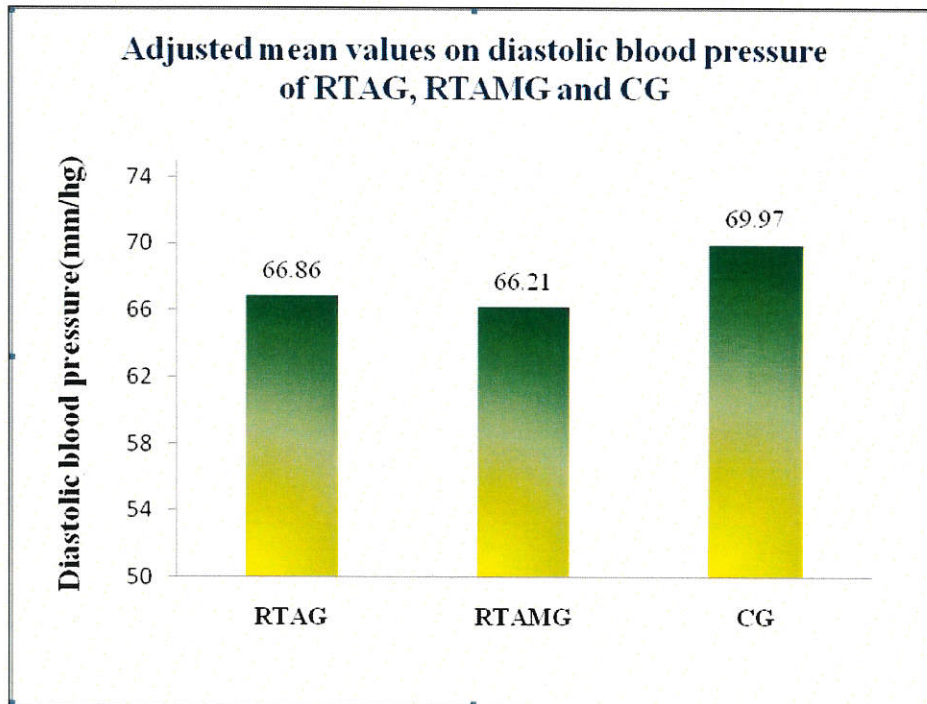


Fig 4.17

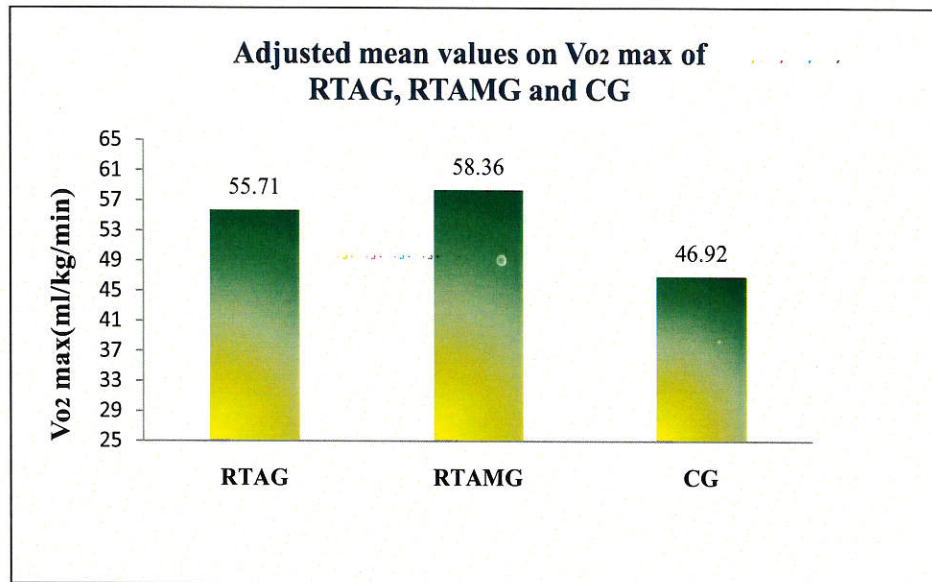


Fig 4.18

4.9 DISCUSSION ON FINDINGS

The purpose of the present investigation was to determine the effect of resistance training with asanas and resistance training with Ayurvedic massage on selected physical fitness components of muscular strength, Muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption of men adults.

4.9.1 Discussion on physical fitness components

The resistance training with asanas group and resistance training with ayurvedic massage group significantly improved upper body muscular strength from the baseline to post training. The upper body muscular strength increased in the resistance training with asanas group from pre (36.25 ± 3.46) to post (44.20 ± 4.41); resistance training with ayurvedic massage group from pre (36.90 ± 3.19) to post (46.15 ± 3.47). The upper body muscular strength significantly improved pre to post in all two experimental groups with no change in control group.

The present study demonstrated that an increase in upper body muscular strength of 25.06% and 21.93% for resistance training with Ayurvedic massage and resistance training with asanas respectively. Whereas the control group did not show any significant improvement on selected physical and physiological variables. The studies of Kwon HR *et al.* (2010) showed that the low intensity resistance training was effective in increasing muscle mass and strength. Marios Christou *et al.* (2006) findings showed that soccer training alone improve the normal growth of maximum strength. The addition of resistance training, however improves more maximal strength of upper and lower body. Moreover, the findings of Jauregui-Ulloa *et al.* (2007) showed that the yoga practice also improves the muscular strength. The findings of Madanmohan *et al.* (2008) showed that the yoga training for a short period of 6 weeks can produce significant increase in muscle strength and the studies of Hagins M. *et al.* (2007) showed that yoga practices improve strength of upper and lower extremities. The findings of Gupta L. and Guru L. V. (1989) showed that Dehamardanam or ayurvedic massage for development of the strength and formation of the body. According to Goodman and Gilman (1996) ksheerabala thaila massage strengthen the nerves and nourishes the muscles and make them firm and strong. Which are also in line with the findings of the present study.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly improved lower body muscular strength from the baseline to post training. The lower body muscular strength increased in the resistance training with asanas group from pre(50.75±8.43) to post (70.25±6.73); resistance training with ayurvedic massage group from pre (53.60±8.78) to post (75.65±9.98). The lower body muscular strength significantly improved pre to post in all the two experimental groups with no change in the control group.

The present study findings showed that the lower body muscular strength in both resistance training with ayurvedic massage and resistance training with asanas groups increased by 41.13% and 38.42% respectively. The findings of Avery D. Faigenbaum *et al.* (1999) and Marios Christou *et al.* (2006) showed that there was a significant improvement in lower body strength after the resistance training. Hagins M. *et al.* (2007) found that yoga practices improve strength of upper and lower extremities. Ankit Jain *et al.* (2011) has mentioned that *Sida cordifolia* the plant used to prepare the *ksheerabala thaila* which have effect on lower body strength, it has been used as a rejuvenative to muscle tissue and muscular system. According to Goodman and Gilman (1996), *ksheerabala thaila* massage strengthen the nerves and nourished the muscles and make them firm and strong. A.N. Rinder and C.J. Sutherland (1995) and J. Kokkonen and J. Allred, (2002) also found that the massage after the resistance training also improves the quadriceps performance.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly improved muscular strength endurance from the baseline to post training. The muscular strength endurance increased in the resistance training with asanas group from pre (25.65±5.31) to post (31.30±4.05); resistance training with ayurvedic massage group from pre (24.50±3.97) to post (31.55±3.24). The muscular strength endurance significantly improved pre to post in all the two experimental groups with no change in the control group.

The present study demonstrated that the muscular strength endurance increased by 28.77% and 22.02% for resistance training with Ayurvedic massage and resistance training with asanas respectively. Whereas, the control group did not show any significant improvement in selected physical fitness components and physiological variables. The finding of A. D. Faigenbaum *et al.* (1999) showed that the high repetition moderate load resistance program improved muscular strength endurance

significantly. A. D. Faigenbaum *et al.* (2007) studies found that, after school resistance training program can improve physical fitness. C.C. Clay *et al.* (2005) has found that hatha yoga is an acceptable form of physical activity for enhancing muscular fitness. Tran M.D. *et. al.*,(2001) has showed in his findings that hatha yoga practice can elicit improvements in the health related aspects of physical fitness.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly improved flexibility from the baseline to post training. The flexibility increased in the resistance training with asanas group from pre(29.30 ± 4.92) to post (40.85 ± 4.42); resistance training with ayurvedic massage group from pre (29.30 ± 4.92) to post (40.85 ± 4.42). The flexibility significantly improved pre to post in all the two experimental groups with no change in the control group.

The present study findings revealed that the flexibility in both experimental groups showed similar increase of 39.41%. Whereas, the control group did not show any significant improvement in flexibility. Keitaro Kubo *et al.* (2002), has found that, there was a significant improvement in flexibility after the resistance training. But the findings of M.L. Bird *et al.* (2009) showed that there was no significant improvement in flexibility after the resistance training. . A. D. Faigenbaum *et al.* (2007) studies found that, after school resistance training program improved physical fitness (flexibility 10%). C.C. Clay *et al.* (2005) and U.S. Ray *et al.* (2001) has found that there was a significant improvement in flexibility after asanas. The findings of Raub J.A. (2002) showed that yoga's stretching and breathing exercises improve our flexibility, helping joints, tendons and muscle stay limber. Ray US *et al.* (2001) has found that there was an improvement at submaximum level of exercise and in anaerobic threshold in the yoga group. Shoulder, hip, trunk and neck flexibility in the yoga group. Kokkonen J. and Allred J., (2002) has found that the massage leg demonstrated higher strength and flexibility gains than no massage leg.

Ramiz Arabaci (2008) has reported that the flexibility has improved after the massage.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly increased cardiovascular endurance from the baseline to post training. The cardiovascular endurance increased in the resistance training with asanas group from pre(14.51±1.37) to post (13.02±1.23); resistance training with ayurvedic massage group from pre (13.91±1.42) to post (12.79±1.10). The cardiovascular endurance significantly increased pre to post in all the two experimental groups with no change in the control group.

The present study revealed that the cardiovascular endurance increased by 10.26% and 8.05% for resistance training with asanas and resistance training with Ayurvedic massage respectively. This finding is in line with the findings of A. D. Faigenbaum *et al.* (2007), who found that there was a significant improvement in cardiovascular endurance after the resistance training. M. Hagins *et al.* (2007) has found that sun salutation posture exceeding the minimum bout of 10 minutes has improved cardio-respiratory endurance for sedentary individuals. The findings of Muralidhara and Ranganathan (1982) showed that power yoga is an excellent form of cardio conditioning, which strengthens core muscles while it keeps blood and oxygen circulating throughout body. The findings of Arciero *et al.* (2009) has revealed that the yoga and functional resistance training has improved the cardio-vascular endurance. Lombardo, John A. MD (2004) has found that the sida cordifolia, the plant is used to prepare the ksheerabala thaila which have effect on cardiovascular endurance which exerts stimulating effect on all tissues which has receptors for it. This includes the nervous system and cardiovascular system.

4.9.2 DISCUSSION ON PHYSIOLOGICAL VARIABLES

The resistance training with asanas group and resistance training with ayurvedic massage group significantly decreased resting pulse rate from the baseline to post training. The resting pulse rate decreased in the resistance training with asanas group from pre(77.10 ± 3.29) to post (71.30 ± 2.34); resistance training with ayurvedic massage group from pre(78.50 ± 2.98) to post (70.85 ± 1.93). The resting pulse rate significantly decreased pre to post in all the two experimental groups with no change in the control group.

The present study demonstrated that the resting pulse rate decreased by 7.52% and 9.74% for resistance training with asanas and resistance training with ayurvedic massage respectively. Whereas, the control group did not show any significant change in cardiovascular endurance. The findings of Muralidhara and Ranganathan (1982), showed that hatha yoga can lower the heart rate. Rajakumar (2010), suggests that, the yogic practice group showed significant improvement due to 12 weeks training on resting pulse rate, breath holding time and peak flow rate compared to the physical exercise and control group. In overall training effects in terms of improved number of physiological variables and their magnitude of improvement through training. Yogic practice group is found to be the better group when compared to others. Dr. Rakesh Dubey and Dr. Alka Nayak(2009) suggests that, asanas exercise have proved significantly effective in improving lung capacity, reaction time and pulse rate. Moreover, the finding of Virginia S. Cozwen and Troy B. Adams (2007) showed that the asthanga yoga has reduced the heart rate significantly. So, the combination of resistance training and yogic practice has decreased the heart rate significantly. Manuel Arroyo-Morales *et al.* (2008) studies suggested that the massage favors the recovery of HRV after high intensity exercise.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly reduced systolic blood pressure from the baseline to post training. The systolic blood pressure improved in the resistance training with asanas group from pre(118.75 ± 6.84) to post

(114.00±5.57); resistance training with ayurvedic massage group from pre (117.95±5.48) to post (110.15±5.54). The systolic blood pressure significantly improved pre to post in all the two experimental groups with no change in the control group.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly improved diastolic blood pressure from the baseline to post training. The diastolic blood pressure improved in the resistance training with asanas group from pre(71.05±3.46) to post (67.45±2.89); resistance training with ayurvedic massage group from pre(70.55±3.30) to post (66.35±3.96). The diastolic blood pressure significantly improved pre to post in all the two experimental groups with no change in the control group.

The present study demonstrated that there is a significant improvement in systolic blood pressure 4% and 6.61% for resistance training with asanas and resistance training with ayurvedic massage respectively. The present study also demonstrated that there is a significant improvement in diastolic blood pressure 5.06% and 5.95% for resistance training with asanas and resistance training with ayurvedic massage respectively. This result is in line with the findings of George A. Kelley and Kristi Sharpe Kelle (2000) that there was a significant reduction in blood pressure after the resistance training. Madanmohan *et al.* (2004) has found that the practices of yoga have reduced the blood pressure significantly. Khanam A.A. *et al.*(1996) findings showed that the yoga in long duration affects hypothalamus and brings about decrease in the systolic blood pressure. The findings of Muralidhara and Ranganathan (1982) revealed that hatha yoga can lower the blood pressure. Manuel Arroyo-Morales *et al.* (2008) studies suggested that the massage favors the recovery of diastolic blood pressure after high intensity exercise.

The resistance training with asanas group and resistance training with ayurvedic massage group significantly increased Vo₂ max from the baseline to post training. The Vo₂ max improved in the resistance training with asanas group from pre(44.79±5.63) to post (55.01±4.51); resistance training with ayurvedic massage group from pre (47.15±6.23) to post (58.75±5.43). The Vo₂ max significantly improved pre to post in all the two experimental groups with no change in the control group.

The present study demonstrated that there is a significant improvement in Vo₂ max 22.81% and 24.58% for resistance training with asanas and resistance training with ayurvedic massage respectively. Arnulfo Ramos-Jiminez *et al.*(2010) studies suggested that yoga training increased Vo₂ max and VE max and HDL-C while TAG and LDL-C remained stable in both middle aged and older groups (p<0.01). The proposed IHY program improves different cardiovascular risk factors (namely Vo₂ max and HDL-C) in middle aged and older women. Mark *et al.*(2007) findings indicated that the regular hatha yoga practice causes absolute and relative maximum oxygen intake increased by 7% and 6% respectively (p<0.01).

Resistance training was incorporated with asanas with an assumption that it may enhance the performance of physical fitness components and physiological variables of the individuals. The result of the study also showed that there is a tremendous improvement in all the selected physical fitness components and physiological variables.

According to Raub J. A. (2002) the three main elements used in hatha yoga to attain its purposes are the body, the physical part of man; the mind, the subtle part; and the element that relates the body with the mind in a special way, the breath. Over the last 10 years, a growing number of research studies have shown that the practice of hatha yoga can improve strength, strength endurance and flexibility, and may help control such physiological variables as blood pressure, respiration and heart rate,

cardiovascular endurance and maximum oxygen consumption to improve overall exercise capacity. The findings of Arciero *et al.* (2009) has found that the yoga and functional resistance training has improved the cardiovascular endurance. The position of the asana causes a squeezing action on a specific organ or gland, resulting in the stimulation of that part of the body. This causes an increase in blood supply to the muscles and ligaments as well as relaxing them. It also takes pressure off nerves in the area. This stretching is involved in all the asanas, since it has such a beneficial effect on the body. While holding the yoga posture we breathe slowly and deeply, moving the abdomen only (abdominal or low breathing). This increases the oxygen and prana supply to the target organ or gland, thereby enhancing the effect of the asana. Blood always carry oxygen and energy to the particular muscle this may be the reason for the significant improvement of muscular strength, muscular strength endurance flexibility and cardiovascular endurance. Some of the relaxing asanas like savasana, vajrasana and yogamudra may have the reason of significant decrease in the in blood pressure and resting pulse rate.

The findings of the study has proved that the inclusion of asanas along with resistance training contributed for better development of physical fitness components like muscular strength, muscular strength endurance and flexibility, and also showed significant improvement in physiological variables such as cardiovascular endurance, Vo2 max and decreased the blood pressure and pulse rate.

The oil that was used for massage was extracted from sida cordifolia plant. Sida cordifolia is a small, erect, downy shrub. The leaves of the plant are chordate-oblong or ovate-oblong and fruits with a pair of awns on each carpel. Roots of the plant which constitute a drug are 5-15 cm long with few lateral roots of smaller size. The tap roots are generally branched at the tip. The outer surface of the root is off to grayish yellow. It is almost odorless with slightly bitter taste (Rangari *et al.*, (1995)). The present review

highlights the contribution of *Sida cordifolia* in modern system of herbal medicine for new drug development.

Ephedrine is sympathomimetic amine that is found naturally in Ma Huang, *Sida cordifolia*. Ephedrine is known to stimulate the central nervous system (CNS) and as such can enhance muscular strength and muscular strength endurance. The plant is alternative tonic emollient, astringent etc., It increases pain tolerance, this may be the reason for the groups that performed resistance training with asanas increased the muscular strength, muscular strength endurance, flexibility and cardiovascular endurance. The plant has depressant rather than the stimulant effect on the central nervous system. That is the reason that the group decreased the blood pressure and heart rate. The plant has a cooling astringent and tonic effect (Ankit jain *et al.* (2011)).

The ayurvedic massage nourished the tissue and increases their strength. It helped the individual to overcome the fatigue because of routine work or exercise. It helped in the promotion and regulation of the proper function of vata. It helped in nourishment of the body and nourished all the tissues of the body. The functions of the vital organs and tissues also improved.

According to Goodman and Gilman (1996) the Ksheerabala Taila strengthen the nerves and muscles. This also helped in the reduction of pain, stiffness and spasm. The prolonged oil application helps in drainage of excessive fluid through lymphatic drainage by stimulating the lymphatic. According to modern medical science absorption through the skin can be enhanced by suspending the drug in an oily vehicle and rubbing the resulting penetration into the skin. Sesame oil is used to prepare the ksheerabala thaila which contains unsaturated fatty acids. The unsaturated fatty acids ensures the maximum of drug absorption the skin. Thus the drugs in the oil also absorbed through the skin and nourish the muscle make them firm and strong.

The ayurvedic massage helped the individual to relieve the muscle spasms and remove the toxin formed in the muscle. According to Mori H. *et al.* (2004) massage is widely believed to have a beneficial effect on treating muscle fatigue and has been used in clinical and sport settings for that purpose. Various efforts have been made to investigate the effects of massage on the circulatory system. However, the results have been contradictory, making it difficult to draw adequate conclusions about the true benefits of massage to the circulatory system. Massage improved circulation and general nutrition of muscles. This appeared to be the most valuable fitness-related benefit. Massage was accompanied or followed by an increase interchange of substances between the blood the tissue cells, which increased tissue metabolism. After a muscle was exercised, vital nutrients must be supplied in order for it to be increased in size. Massage maximizes the supply of nutrients and oxygen though increased blood flow, which helped the body rebuild itself. Massage improved the range of motion and muscle flexibility. This results in increased power and performance, which helped to work efficiently and with proper intensity to facilitate the body's muscle-building response. Massage helps to shorten recovery time between workouts. Waste products such as lactic and carbonic acid build up in muscles after exercise. Increased circulations to these muscles helped to eliminate toxic debris and shorten recovery time.

The massage won't build muscle directly; it helped to facilitate the body's rebuilding phase following a workout and influences muscular growth. This may be the reason for significant improvement of physical fitness components like muscular strength, muscular strength endurance and flexibility. Getting a massage is just as important as regular workouts and supportive nutrition for a comprehensive fitness program.

The findings of the study has proved that the inclusion of ayurvedic massage along with resistance training contributed for better development of physical fitness components like muscular strength, muscular strength

endurance and flexibility, and also showed significant improvement in physiological variables such as cardiovascular endurance, Vo2 max and decreased the blood pressure and pulse rate.

4.10 DISCUSSION ON HYPOTHESIS

Earlier, the researcher had formulated the following hypothesis.

At first, it was hypothesized that the resistance training with asanas would significantly improve the selected physical fitness components of muscular strength, Muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption of men adults. The result of the study showed that there was a significant improvement in resistance training with asanas group on the selected physical fitness components of muscular strength, muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption of men adults. Hence the researcher's first hypothesis was accepted.

In second, it was hypothesized that the resistance training with ayurvedic massage would significantly improve the selected physical fitness components of muscular strength, Muscular strength endurance, flexibility, cardiovascular endurance, and physiological variables of resting pulse, blood pressure and maximum oxygen consumption of men adults. The result of the studies showed that there was a significant improvement in resistance training with ayurvedic massage group on the selected physical fitness components of muscular strength, muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption of men adults. Hence the researcher's second hypothesis was accepted.

In third, it was hypothesized that none of the treatment groups namely resistance training with asanas and resistance training with ayurvedic massage would be better than the other in developing the selected physical fitness components and physiological variables of men adults. The result of the study showed that resistance training with ayurvedic massage is more effective than resistance training with asanas in increasing selected physical fitness components of muscular strength, Muscular strength endurance, flexibility and physiological variables of maximum oxygen consumption and decreasing resting pulse rate and blood pressure of men adults except cardiovascular endurance in which resistance training with asanas performed better.

In fourth, It was also hypothesized that the experimental groups namely resistance training with asanas and resistance training with ayurvedic massage would significantly improve the selected physical fitness components of muscular strength, muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption better than the control group of men adults. The result of the studies showed that the experimental groups namely resistance training with asanas and resistance training with ayurvedic massage would significantly improve the selected physical fitness components of muscular strength, muscular strength endurance, flexibility, cardiovascular endurance and physiological variables of resting pulse rate, blood pressure and maximum oxygen consumption better than the control group of men adults. Hence the researcher's fourth hypothesis was accepted.